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THIRTEENTH ANNUAL REPORT OF THE DIRECTOR.

SUBMITTED TO THE TRUSTEES JANUARY 8, 1902.

To the Board of Trustees of the Missouri Botanical Garden:

The following report on the Missouri Botanical Garden and the Henry Shaw School of Botany, of Washington University, is respectfully submitted in compliance with the rules of the Board.

THE BOTANICAL GARDEN.

During the year just closed, the ornamental features of the Garden were of the same general character prevalent during recent years, lawns, attractive or instructive groups of trees, shrubbery and hardy herbaceous plants, and decorative bedding being the open-air features, while in the plant houses special collections were strengthened and the effectiveness of their display was increased by changes in disposition and by the removal of the central staging in places, notably in the house devoted to tropical plants. This year, for the first time, the bromeliads, numbering something over 100 species, were brought together in a house exclusively devoted to plants of this group, and they now form a striking and interesting feature of the collection sheltered under glass.

Gardening of every description was rendered unusually difficult and expensive by the extreme heat and prolonged drought which marked the season of 1901. In order that these may be understood, I have prepared a few temperature and precipitation curves, which are incorporated in this report, since they present the climatic conditions to the eye in a graphic manner.

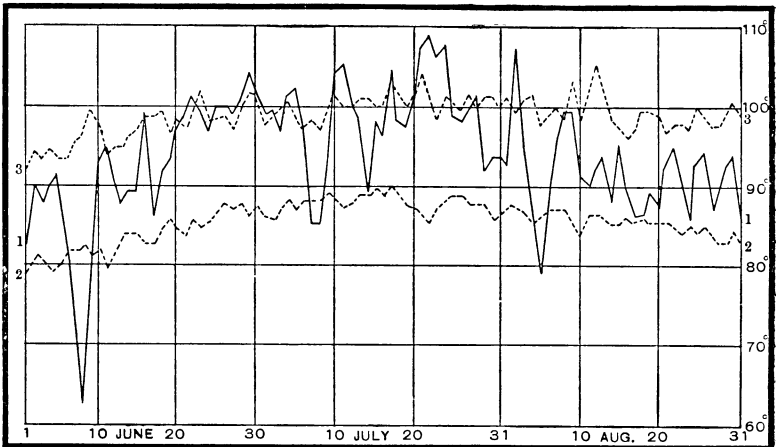
On the diagram marked A, the maximum daily temperature recorded at the Garden during the months of June, July and August, 1901, is represented by the full line, 1.



THE ROCKERY—*OPUNTIA MISSOURIENSIS*.

For comparison, the dotted line, 2, representing the average daily maximum for the same months, has been compiled from Dr. Engelmann's tabulation of his observations covering 47 years,* ending with 1882; and the dotted line, 3, represents the highest maximum ever reached for each day of this period, as recorded in the same tables. Though far

DIAGRAM A.



SUMMER TEMPERATURES.

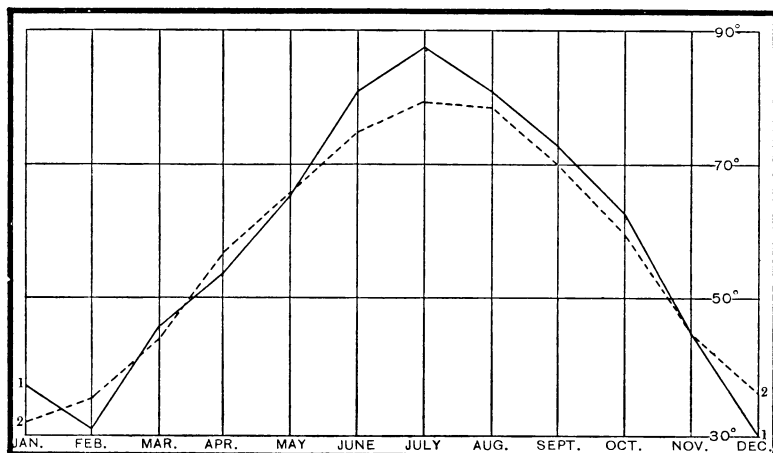
more irregular than the curve of averages, as would be expected, the record for 1901 is lower than the average on but six days of the entire period considered, during the middle portion of which its course is approximately parallel with and close to the curve of maxima for the entire 47 years tabulated, and on no less than 22 days this latter curve is exceeded.

The diagram marked B, covering the entire year, represents the mean monthly temperature for 1901 in a full

* Trans. Acad. Sci. of St. Louis. 4: 496-508. — This record covers the hottest season recorded before the one just closed (1881), and there is no reason to believe that the direction or position of the curve would have been materially changed by the incorporation of the records of recent years, so I have not taken the trouble to average in the records derivable from the reports of the Weather Bureau.

line, and the average mean monthly temperature for the past thirty-one years in a dotted line, as derived from the current monthly bulletins of the St. Louis station of the United States Weather Bureau. Taking account of the minimum as well as the maximum temperatures, this diagram shows even more clearly the excessive warmth of the past year, between the months of May and November.

DIAGRAM B.



MEAN MONTHLY TEMPERATURES.

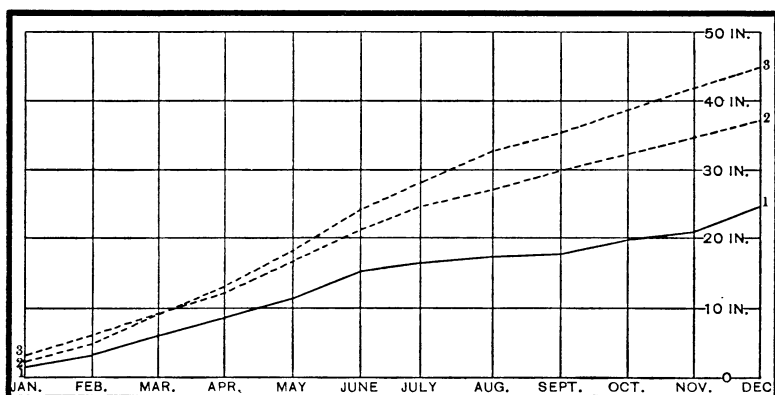
On the diagram marked C, the full line, 1, represents cumulatively the precipitation for 1901, amounting to 24.8 inches, as shown by the same monthly bulletins of the Weather Bureau, from which has been platted, also, the contrasted dotted curve, 2, representing the average precipitation for the last thirty-one years, amounting to 37.27 inches annually. It will be observed that the rainfall for 1901, which at no time before December reached the average, though in December, because of one heavy shower, it exceeded it, has otherwise continually fallen behind the latter, until at the end of the year it is 12.47 inches short of the yearly average of 37.27 inches.

In compiling this curve, I was struck with the great dif-

ference it shows between the average precipitation of the last thirty-one years and the comparable average obtained by Dr. Engelmann * for a period of twenty-three years ending with 1861, and I have added to the diagram the dotted line, 3, representing his averages, amounting to 44.92 inches for the year.

The monthly distribution of rainfall for 1901, 1, as compared with the average for the preceding thirty-one

DIAGRAM C.



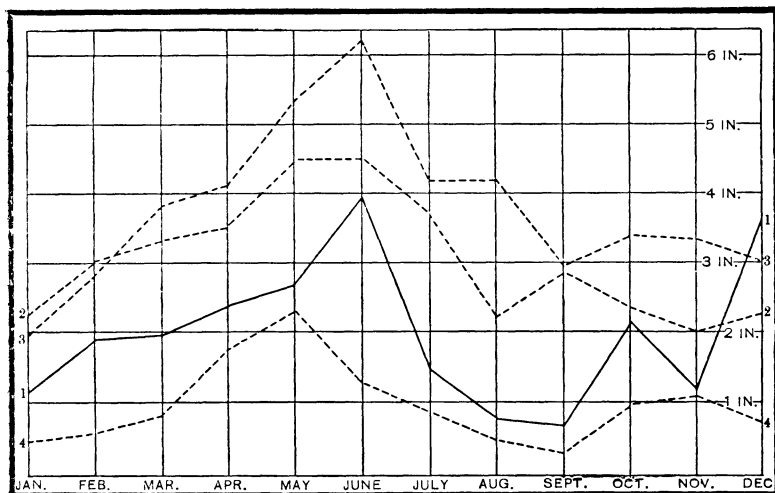
PRECIPITATION — CUMULATIVE.

years, 2, and the average for the twenty-three years covered by Dr. Engelmann's observations, 3, is more clearly shown on the diagram marked D, compiled from the same sources as the preceding one. If reliable, the curves on these two diagrams show that though slightly heavier toward the end of winter than formerly, the rainfall has very much decreased in the last forty years, and, unless the variations from year to year are too great to permit of the drawing of even approximately trustworthy averages from such periods of time as twenty or thirty years, they appear to indicate a change in climate which is not only hard to explain but which, if it continues, may within a compara-

* Trans. Acad. Sci. of St. Louis, 2:75-9.

tively short time prove most disastrous to agriculture as well as gardening in this section. Further data bearing on this question are afforded by a paper by Professor Nipher (Trans. Acad. Sci. of St. Louis. 5: 383-433), from which the following figures are taken: 1837-1855, 42.43 in.

DIAGRAM D.



PRECIPITATION — BY MONTHS.

(Smithsonian tables); 1841-1861, 40.67 in. (Jefferson Barracks); 1862-1879, 38.73 in. (Engelmann); 1871-1887, 38.56 in. (Weather Bureau); and 1878-1887, 38.60 in. (Washington University).

Unlike the temperature, the rainfall for this season has nowhere reached the extreme noted by Dr. Engelmann, whose minimum monthly records are shown by the dotted line, 4, on this diagram, though in November the precipitation was only .1 in. higher than the November minimum shown by his tables.

As a result of the unfavorable season, a few established trees, and a considerable number of others newly planted, and therefore with deficient root system, died or showed

unmistakable signs of injury, and it was only by the constant use of water at night, during the heated spell, that the lawns and decorative beds could be kept in creditable condition; but it is a matter for congratulation that the immediate losses were comparatively small, considering the severity of the season. It should be added, however, that unless the precipitation of late winter and early spring far exceeds the average,—and as the drought still continues there is little reason to hope for this,—the fall of the level of the so-called soil water is such, with reference to the depth of penetration of the roots into the soil, as to warrant grave doubts as to the fate of many of the older trees when their foliage is expanded in the spring, and particularly when transpiration is increased by the heat of summer.

The variety of plants in cultivation continues to show a desirable increase. In 1900, 9,194 species or varieties were cultivated.* In 1901, 1,700 were added, and 927, mostly transient horticultural forms, dropped out of cultivation, leaving a net gain for the year of 773, bringing the number of species and varieties now cultivated up to 9,967.

Surplus plants have been disposed of from time to time, largely by gift to hospitals and schools, 2,948 plants having been so distributed; and 388 plants, 606 cuttings, and 262 packets of seeds, collectively valued at \$158.55, were distributed to correspondents. In exchange for this material or the publications of the Garden, or as gifts, 161 consignments, comprising 4,978 plants or packets of seeds, and valued at \$569.65, were received; 62 entries, including 5,467 numbers, valued at \$389.60, were propagated or collected by employees, and 109 consignments, consisting of 14,777 plants or packets of seeds, were purchased, the expenditure for these, as shown by the Secretary's books, amounting to \$2,829.61.

Some 20,000 more persons visited the Garden in 1901

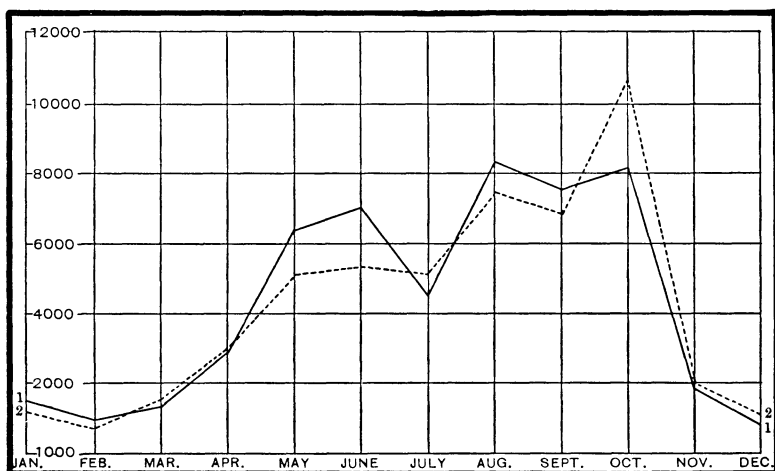
* Rept. Mo. Bot. Gard. **12**:13.



THE BOG—SARRACENIA FLAVA.

than in any previous year for which records have been kept, the total number for the year amounting to 91,262. Of this number 18,982 were counted on the first Sunday afternoon in June, and 21,348 on the first Sunday afternoon in September, on which afternoons, in accordance with the provisions of Mr. Shaw's will, the Garden was open.

DIAGRAM E.



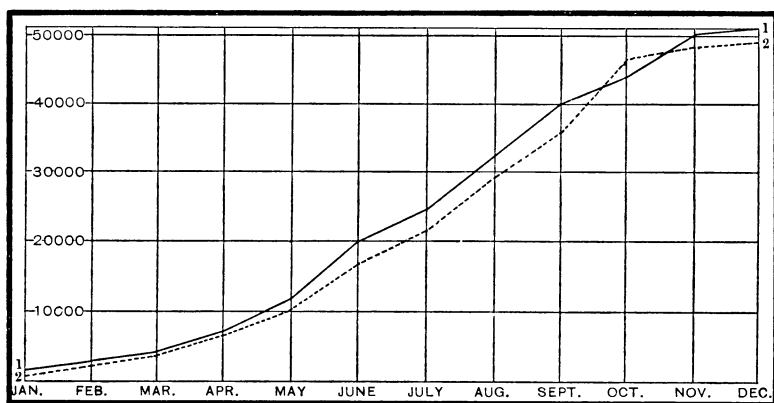
VISITORS ON WEEK DAYS—BY MONTHS.

The distribution of week-day visitors through the season is shown by the full line on the accompanying diagram, E, on which, for comparison, are placed in a dotted line the monthly averages for the preceding years for which records have been kept. It will be observed that though reduced in July, doubtless because of the excessive heat, the number of visitors from May to September inclusive was considerably above the average. On the other hand, the number for October, always large because of the presence of strangers in the city for the autumnal festivities, and varying greatly from year to year, since the greater number of these chance visitors are attracted by the events of only one or two days, which may happen to be inclement, in 1901 fell some 2,500 below the average.

The diagram marked F, cumulatively representing, in full line, the week-day visitors for 1901, and, in dotted line, the cumulative average for the previous years for which records exist, shows the same facts in a different form.

The visitors on the two Sunday afternoons, not included in the preceding curves, reached the number of 40,330, constituting 45 per cent. of the total for the year. This number is much larger than usual, and has been

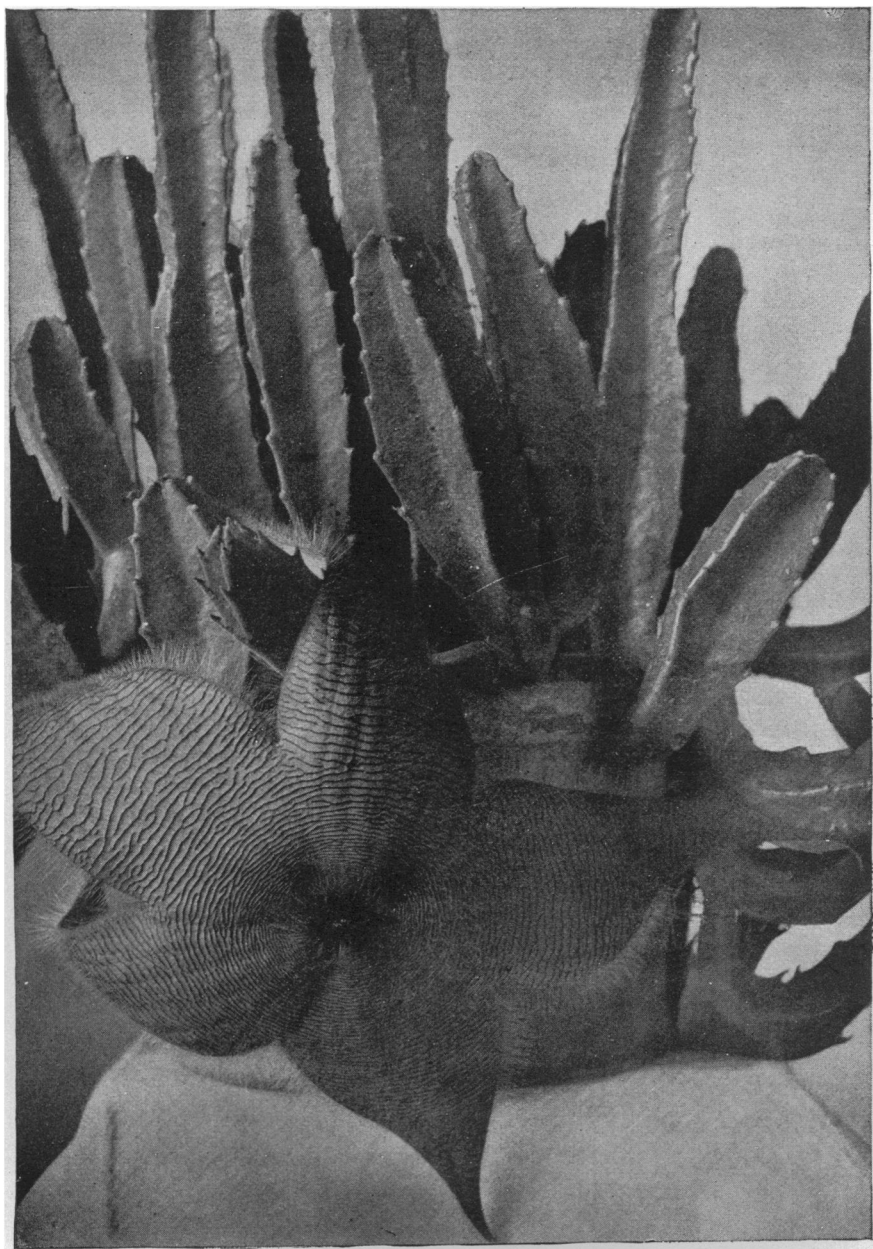
DIAGRAM F.



VISITORS ON WEEK DAYS — CUMULATIVE.

approached only once, in 1895, when it was exceeded, 43,072 persons having been counted on the two open Sundays of that year. The condition of the weather largely controls the number of visitors on these, the only holidays on which, under Mr. Shaw's will, the Garden may be opened, and their fluctuation from year to year is shown on the accompanying diagram, G, by a full line, the average up to 1901 being shown on the same diagram by a horizontal dotted line.

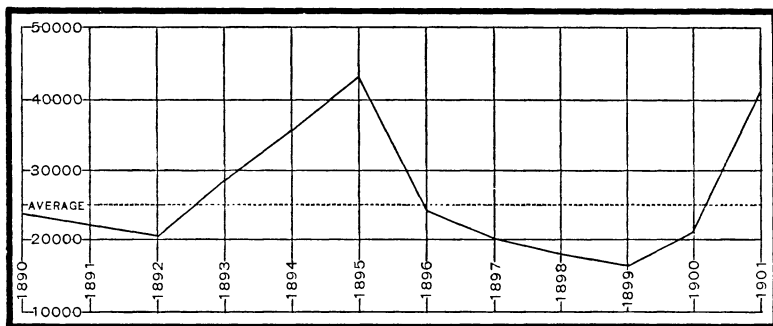
The customary current collections have been purchased for the herbarium, and 16,256 sheets of specimens were incorporated during the year just closed. Of these, 6,997, valued at \$349.85, were received by gift or in



STAPELIA GRANDIFLORA.

exchange for material or publications, 3,715 were collected by employees of the Garden, and 5,544 were bought. The Secretary's books show that the expenditure on the herbarium for the year amounts to \$1,175.39. During the year 20 mounted sheets, valued at \$3.00, and 2,325 unmounted specimens, valued at \$116.25, were distributed to

DIAGRAM G.



VISITORS ON SUNDAYS — BY YEARS.

other institutions, by way of exchange, while various fragments, of no nominal value, were sent to correspondents for research purposes. Forty-eight sheets further were withdrawn from the mounted collection and laid away for exchange purposes.

The mounted herbarium, as now constituted, consists of the following material:—

The Engelmann Herbarium (all groups) about . . . 97,800 specimens.

The General Herbarium:—

Higher plants.

The J. J. Bernhardt Herbarium . 61,121

The J. H. Redfield Herbarium . 16,447

Other specimens 165,643 243,211 “

Thallophytes.

The J. J. Bernhardt Herbarium * 126

Other specimens 23,816 23,942 “

Making a total of about 364,953 “

Valued at \$54,742 95†

* So far as yet incorporated.

† This valuation, at the rate of \$15.00 per hundred mounted sheets.

In addition to the above the Garden owns some 30,000 unmounted specimens, which it is hoped may soon be incorporated.

The following, practically a part of the herbarium facilities, are the same as last year: —

Wood specimens of various sizes	1,027, valued at	\$100 00
Wood veneers by Hough and others	2,279 “ “	160 00
Microscope slides by Penhallow and others	1,051 “ “	250 00
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Together	4,357 “ “	\$510 00

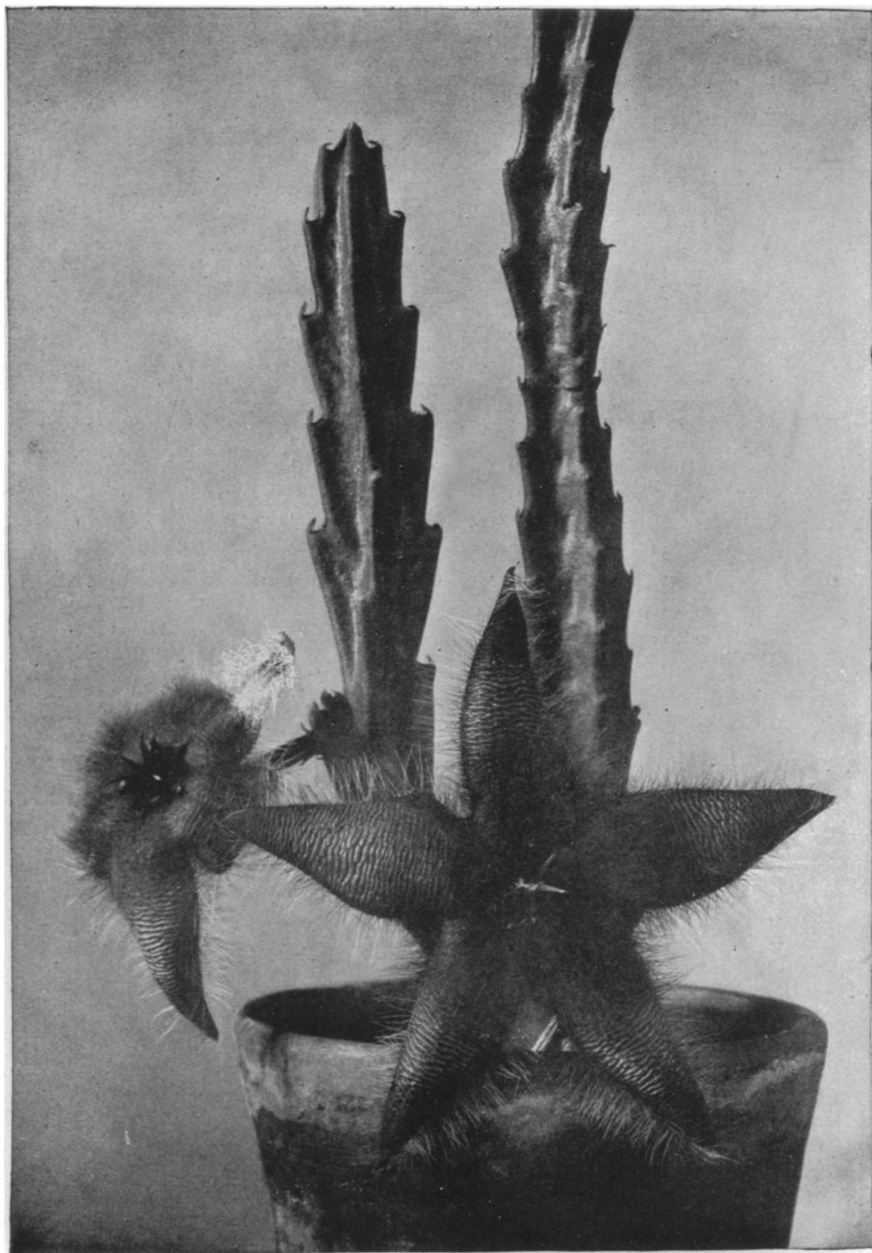
The additions to the library include 423 books and 10 pamphlets purchased, and 506 books and 244 pamphlets, valued at \$883.36, presented or sent in exchange for Garden publications. During the year \$2,688.71 was spent for additions to the library and for binding and pamphlet covers.

The card index was enlarged by the incorporation of 16,369 new cards, of which 5,894 were bought, 875 were presented, and 9,600 were written by employees, practically none of the latter class having been added since midsummer, when the work was broken off by the death of Miss Reed, who was then taking her vacation.

As now constituted, the library contains: —

Pamphlets	19,916		
Books (general)	15,571		
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	35,487	valued at	\$57,190 25
Books (Sturtevant Prelinnean Library *)	463	“ “	2,315 00
Manuscript volumes (Shaw, Engelmann and Roetter)	66	“ “	800 00
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Total	36,016	“ “	\$60,305 25

* The original number and arbitrary valuation of the collection presented by Dr. Sturtevant. (Report. 8 : 21.) See note in Report. 12 : 16.



STAPELIA RUFESCENS.

Index cards.

Various	223,184
Sturtevant Index	52,300

Total	275,484	valued at	\$2,754 84
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Total valuation of library	\$63,060 09
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At present, 1,133 serial publications are received at the library. Of these, 101 are purchased, and 1,032, issued by 765 institutions or publishers, are presented or received in exchange for the Reports of the Garden.

Of the small handbook of the Garden, issued in 1893, and now antiquated, 196 copies were sold in 1901, and twenty-one copies were given away.

As in other years, visiting botanists and correspondents have been given every possible facility for the use of the library, herbarium and collection of living plants, and several advanced students are now occupied in special resident study. In the summer a small plant house, similar in construction to and adjoining the vegetable house, was erected for the important research work on the causes of the decay of timber, etc., being conducted by Dr. von Schrenk of the School of Botany, in connection with the United States Department of Agriculture.

Reference has been made above to the death, on July 7th, of Miss Eva M. Reed, who for some eight years had occupied the position of indexer in the library. From the first of January, 1902, Miss Mary A. Norton has been appointed indexer, to fill the vacancy caused by Miss Reed's death. In August, Mr. J. B. S. Norton, who had filled the position of botanical assistant for about five years, left the Garden to become Professor of Botany and Vegetable Pathologist at the Maryland Agricultural College, and the vacancy resulting was filled by the appointment of Mr. J. Arthur Harris, a graduate of the University of Kansas.

Approximately the same amount of time as in preceding years has been given by the herbarium and office staff to

research work, some of the results of which have already been published, while others are in various states of advancement. My own study of the yuccas and related plants, to which reference was made in my last report, has been continued through the past year as opportunity has offered, and the results will probably be published in the thirteenth volume of the Garden Report. In the prosecution of this work, the "sea-island" region of the South Atlantic coast and the semi-desert region extending from eastern California onto the Mexican table land and down to the Gulf at Tampico, were visited last year.

One garden pupil, Arthur R. Gross, who had completed the prescribed course of study, was admitted to examination and granted the Garden certificate in March last, and the vacancy so caused was filled by the appointment of John H. Tull, who had been a paying pupil for a year previous,—the appointment being made on the result of competitive examinations. Since April last, Miss Herta A. Toeppen, a graduate of the Mary Institute of St. Louis, has been taking the gardening course as a paying pupil under the provisions made by the Board, and during the summer two boys were temporarily received on the same basis.

Four annual events, provided for in the will of Mr. Shaw, have taken place, as follows:—

The preaching of a sermon on the wisdom and goodness of God, as shown in the growth of flowers, fruits and other products of the vegetable kingdom; the twelfth banquet to the Trustees of the Garden and their guests; the twelfth banquet to the gardeners of the institution and invited florists, nurserymen and market gardeners; and the award of premiums and prizes at a flower show held in St. Louis.

The flower sermon was preached in Christ Church Cathedral, St. Louis, on the morning of May 19, by Rev. Henry L. Foote, of Marblehead, Mass., and many of the audience carried to the church flowers, which were afterwards sent to the sick in hospitals.

The Trustees' banquet was given at the Southern Hotel, St. Louis, on the evening of May 18. Covers were laid for fifty-two persons, comprising, in addition to members of the Board, representative citizens of St. Louis, and members of the scientific staff of several universities. Professor E. A. Engler presided. Speeches appropriate to the occasion were made by Professor C. M. Woodward, Mayor Rolla Wells, Hon. Isaac H. Lionberger and Rev. C. H. Patton.

The twelfth annual banquet to the gardeners of the institution and invited florists, nurserymen and market gardeners was given at the Mercantile Club on the evening of December 7. About ninety persons were present, among whom were the gardeners of the Botanical Garden, officers of the St. Louis Florists' Club and a considerable number of representative florists; officers of the local Market Gardeners' Association and other representative market gardeners, seedsmen and nurserymen; a number of professional and amateur horticulturists from St. Louis and various parts of Missouri and adjacent states; representatives of the press; a number of gentlemen from St. Louis and other cities who are interested in the growth of trees as a means of civic improvement and beautification; members of the office staff and Board of Trustees of the Garden; and the instructors in the Henry Shaw School of Botany. The Director of the Garden presided, in accordance with the provisions of Mr. Shaw's will, and after the dinner the need, possibility and means of securing a large increase in the planting of shade trees along the streets of the city were discussed, the speakers of the evening being Mr. F. W. Taylor of the Louisiana Purchase Exposition, Mr. F. N. Judson, Mr. Paul F. Coste, Mr. W. J. Stevens, Judge A. O. Marshall, President of the Board of Education of Joliet, Illinois, Mr. James H. Ferriss, editor of the Joliet Daily News, and Dr. Hermann von Schrenk, of the Shaw School of Botany. The last-named gentleman, on behalf of

a committee of the Engelmann Botanical Club, presented a comprehensive working plan for securing the desired end.

The award of premiums at a flower show was again intrusted to the St. Louis Florists' Club, and the awards were made at an exhibition held under the auspices of the Club in the Masonic Temple, from November 13 to 15 inclusive.

THE SCHOOL OF BOTANY.

Essentially no changes were made in the character and scope of the undergraduate botanical work at Washington University during the year just closed, and reference may be made to my last report * for a tabulation of the electives offered. The degree of Doctor of Philosophy was conferred in June on one candidate, Mr. Herbert J. Webber, for work in botany, conformed to the requirements of the University. Dr. Webber's thesis, entitled Spermatogenesis and fecundation of *Zamia*, has recently been published as Bulletin No. 2 of the Bureau of Plant Industry of the United States Department of Agriculture.

In the early part of the year, Mr. Herbert F. Roberts, Instructor in Phanerogamic Botany, resigned his position to fill the chair of botany at the Kansas Agricultural College, and Mr. Samuel Monds Coulter was shortly afterward appointed to the Instructorship.

Though no special effort was made to provide for popular botanical instruction, a class of ten ladies, occupied with a study of the commoner cultivated plants and weeds, was met at the Garden by Miss Ellen Clark of the Mary Institute, on Saturdays during the month of July, and a gratifying feature of the year has been the increasing number of teachers in the public schools who have brought their classes to the Garden for open-air study through the school year.

Very respectfully,

WILLIAM TRELEASE,

Director.

* Report Mo. Bot. Garden. 12: 19.